Northwest climate change and some thoughts about insurance

Philip Mote

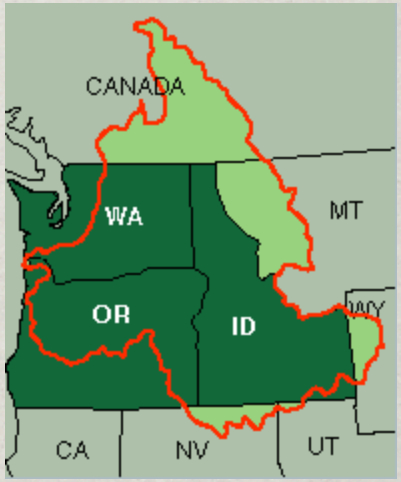
Climate Impacts Group

University of Washington

The Climate Impacts Group

http://www.cses.washington.edu/cig/

Goal: help the Pacific Northwest become more resilient to climate variations and climate change



Supported by NOAA Office of Global Programs

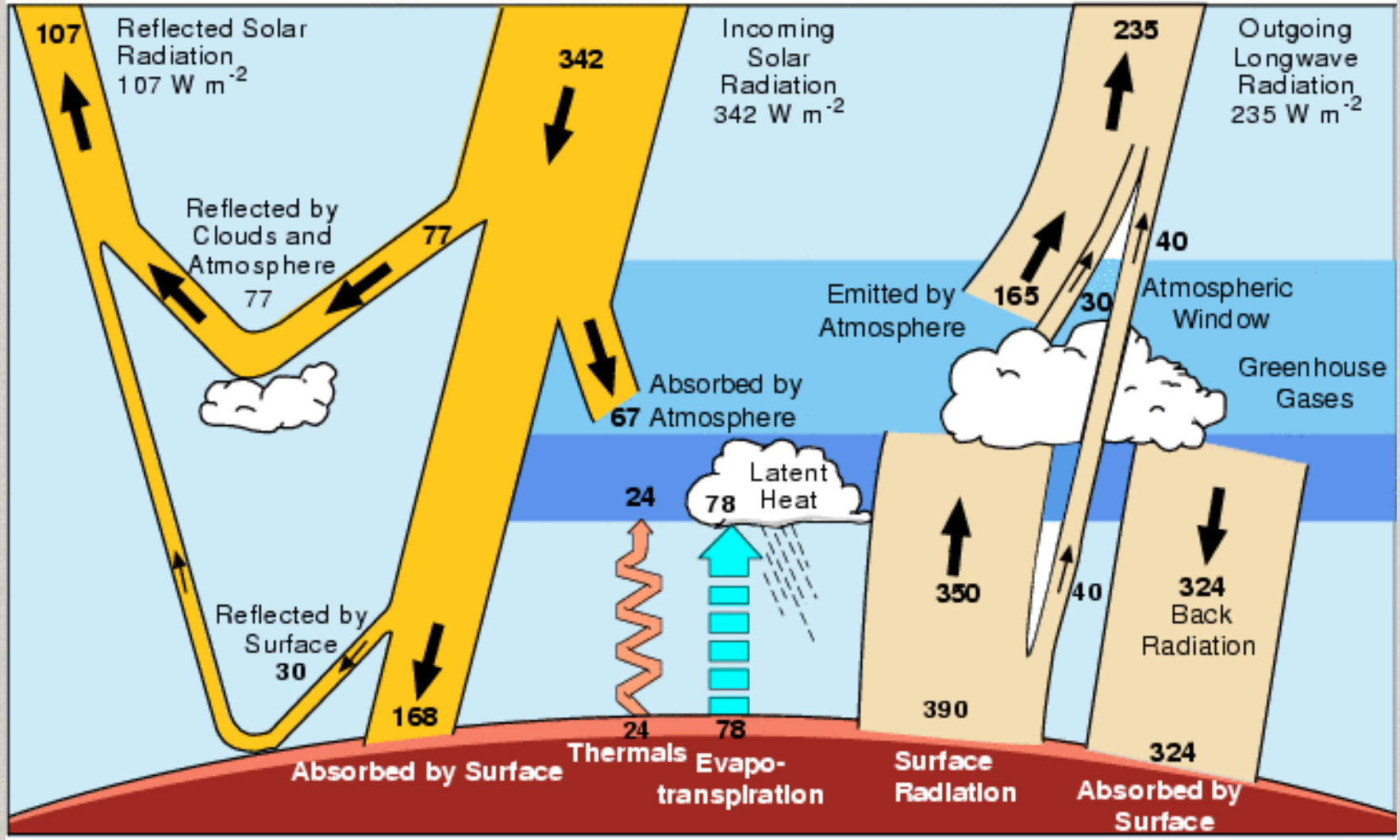
Main points

- Human influence on climate *has* emerged
- Northwest impacts of relevance include changing precipitation intensity and flood risk, sea level rise, forest fires

Science of climate change

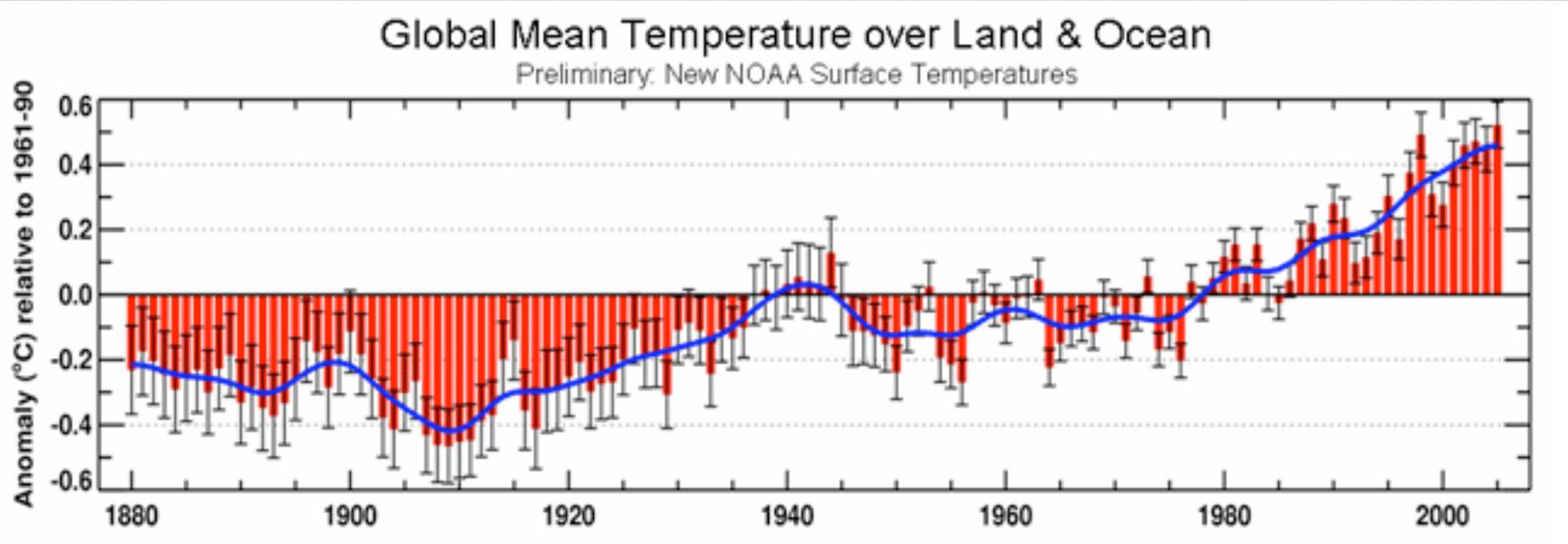
- Thousands of peer-reviewed scientific papers
- Intergovernmental Panel on Climate Change (IPCC)
- Major reports in 1990, 1996, 2001, 2007
- Conclusions:
  - "An increasing body of observations gives a collective picture of a warming world and other changes in the climate system."
  - "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."

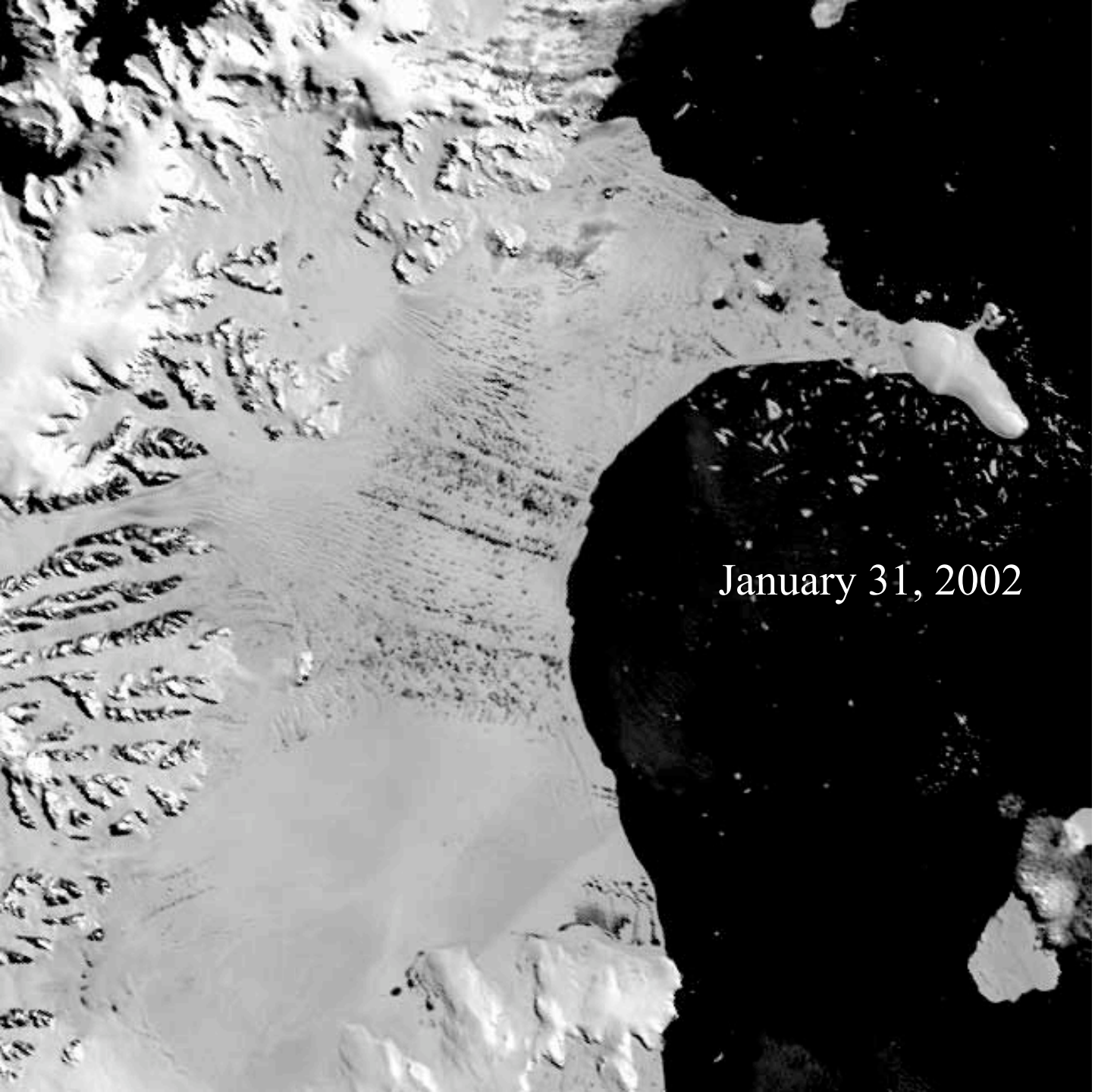
Global Heat Flows



Kiehl and Trenberth 1997

Variations of the Earth's surface temperature

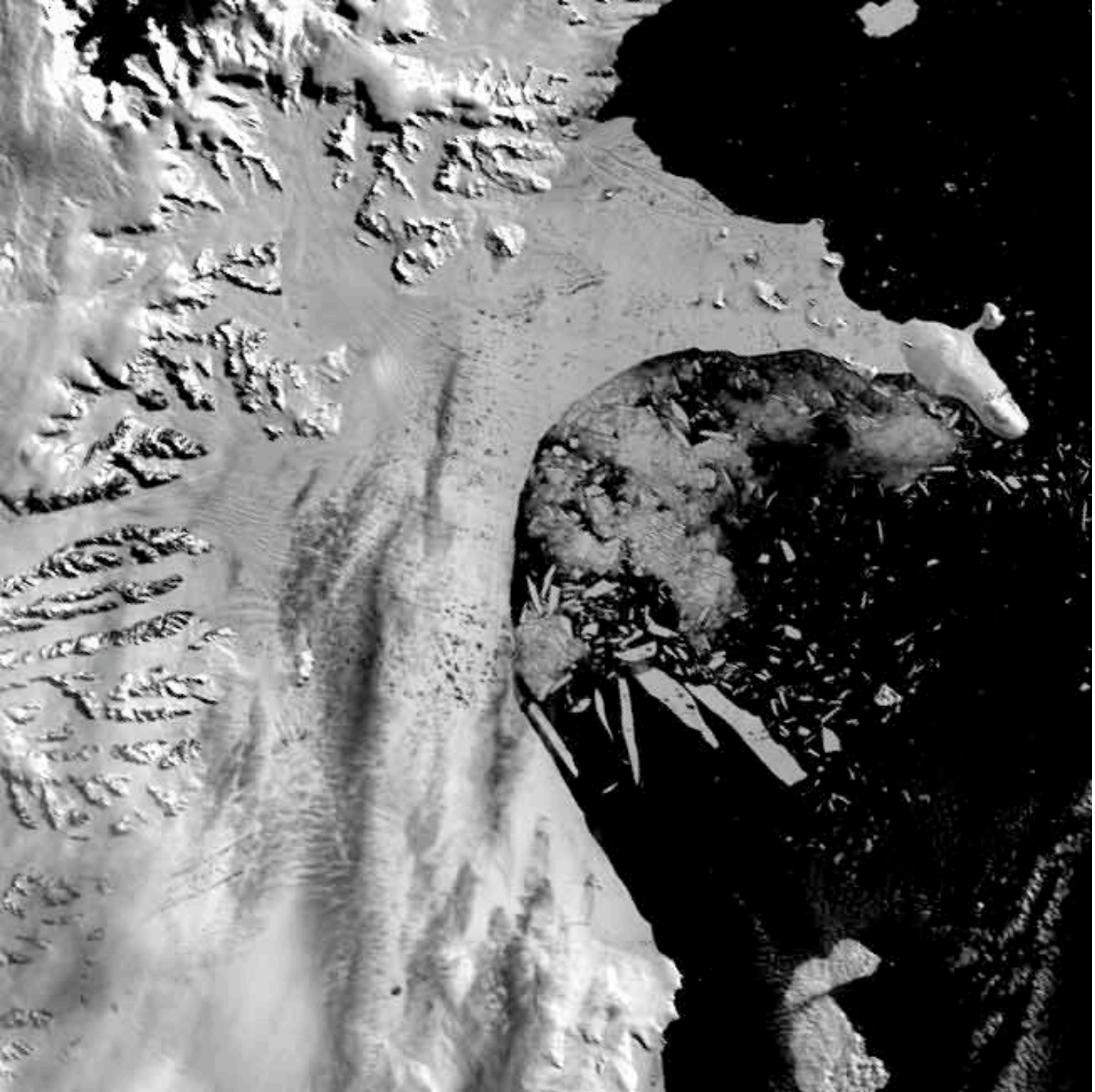




Larsen B
Ice shelf
Antarctica

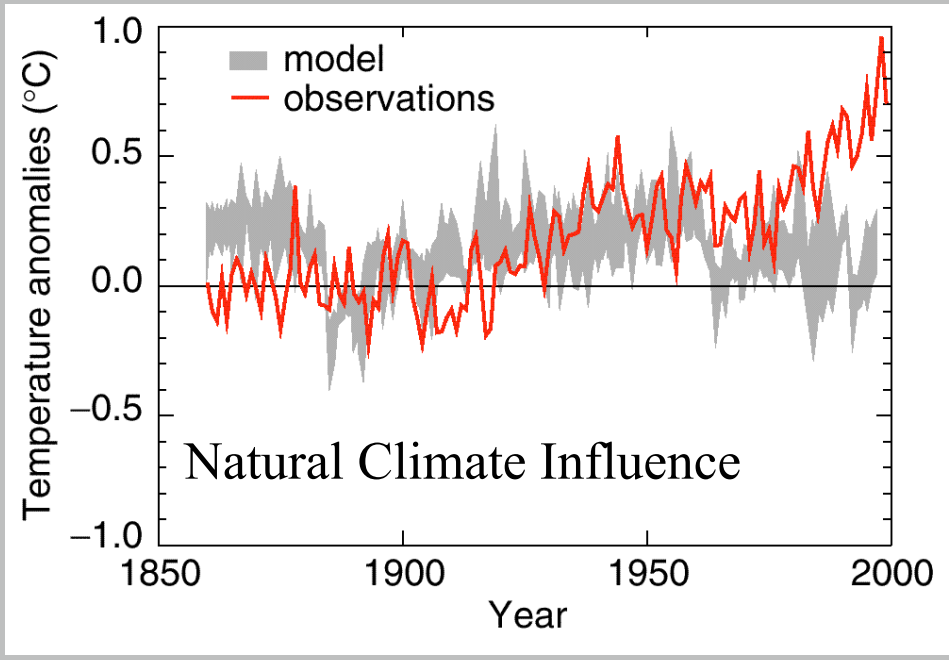
MODIS data
Courtesy NSIDC

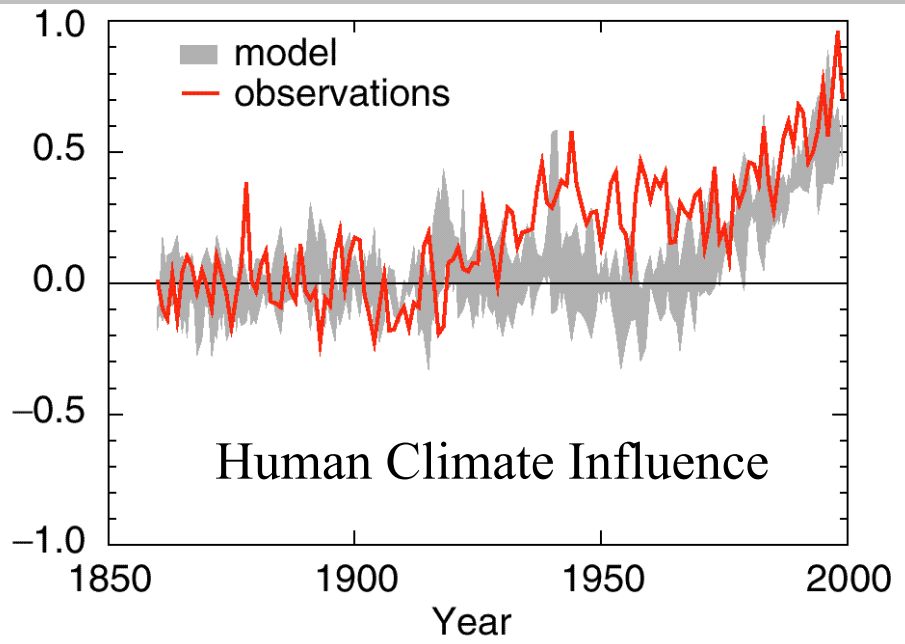
February 17

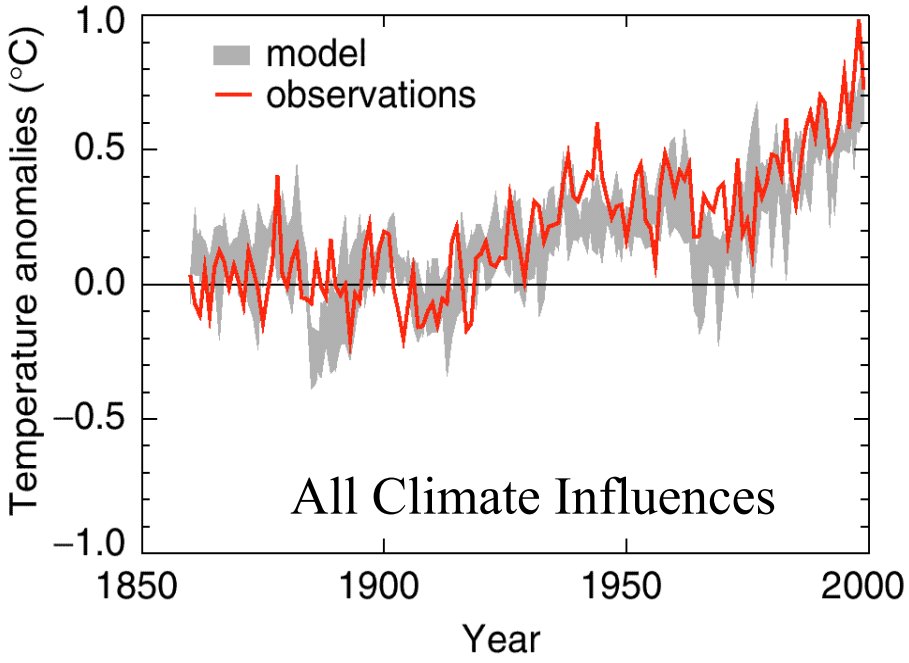


February 23

March 5


model
observations
Temperature anomalies (°C)
1.0
0.5
0.0
−0.5
−1.0
1850
1900
1950
2000
Year
Natural Climate Influence

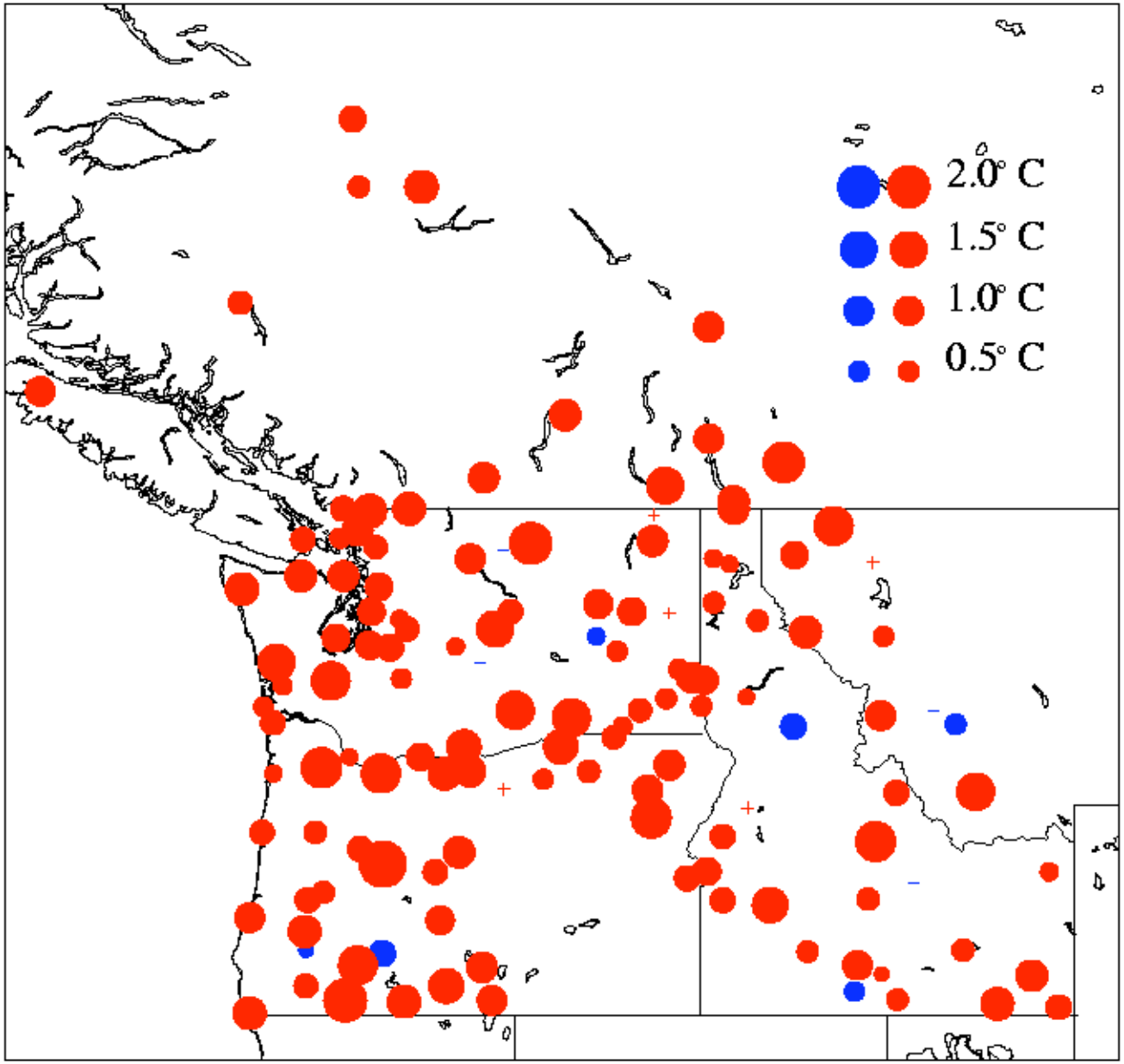

model
observations
1.0
0.5
0.0
−0.5
−1.0
1850
1900
1950
2000
Year
Human Climate Influence


model
observations
Temperature anomalies (°C)
1.0
0.5
0.0
−0.5
−1.0
1850
1900
1950
2000
Year
All Climate Influences

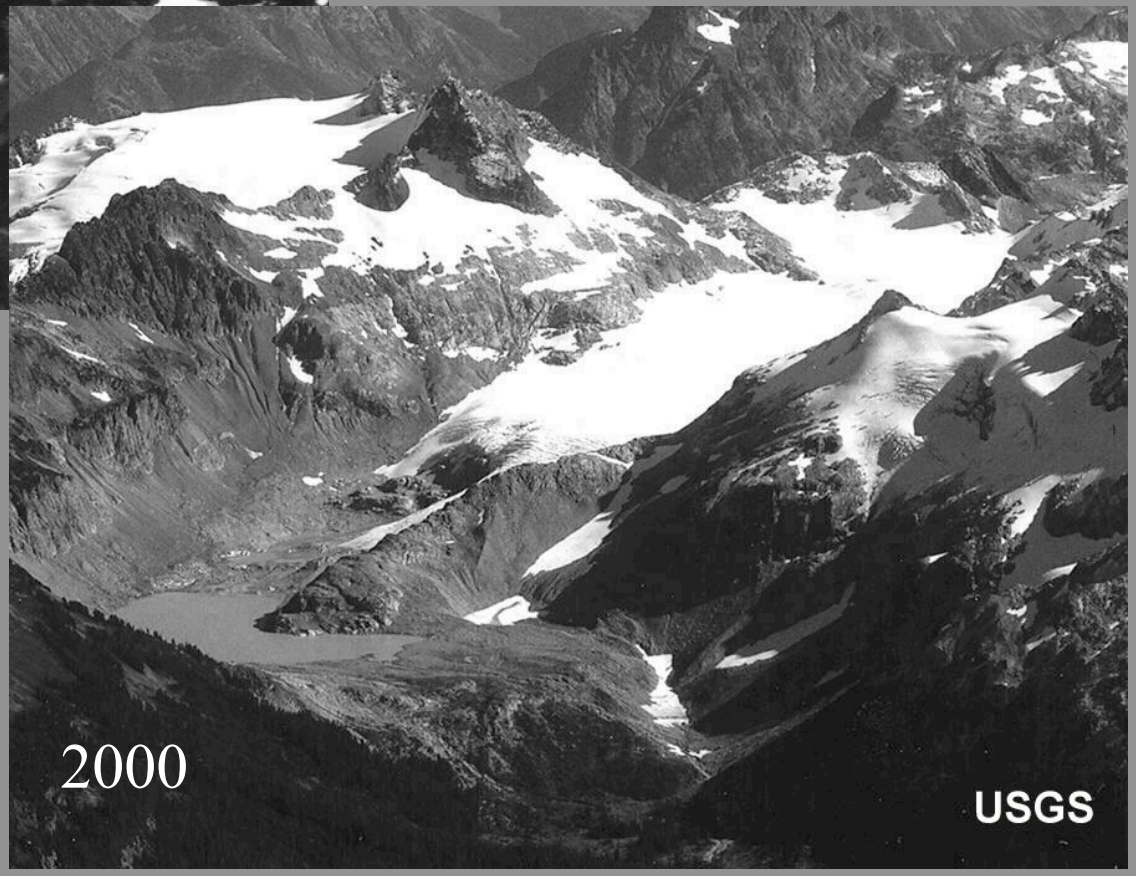
Northwest changes and impacts

- substantial warming (0.8°C, 1.5°F)
- glacial retreat
- reduced spring snowpack ==> changing flood risk
- no observed change in precipitation intensity
- increased risk of forest fire

Temperature trends (°C per century), since 1920

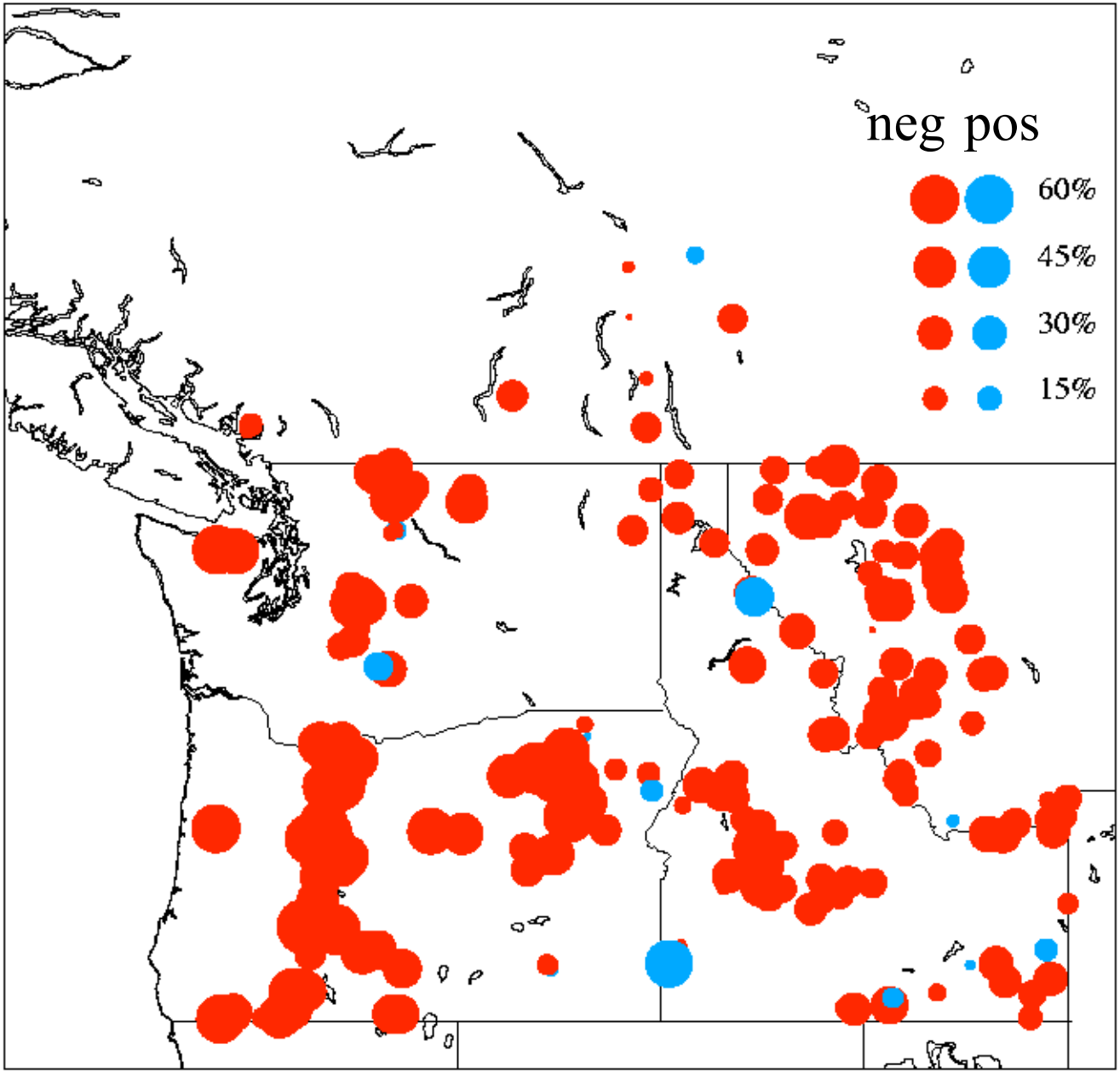


The South Cascade glacier retreated dramatically in the 20th century



Courtesy of the USGS glacier group

Trends in April 1 snow water equivalent, 1950-2000



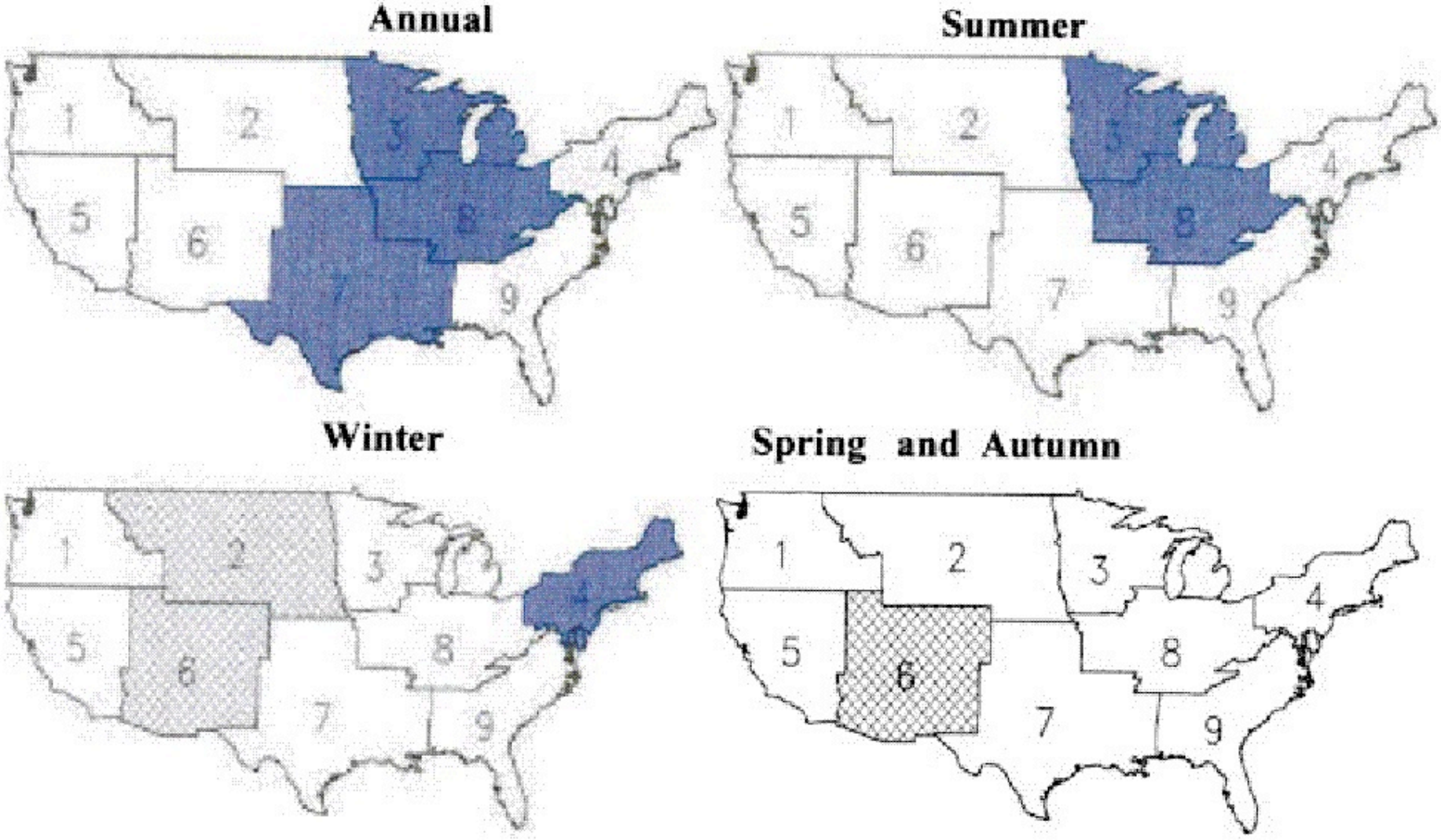
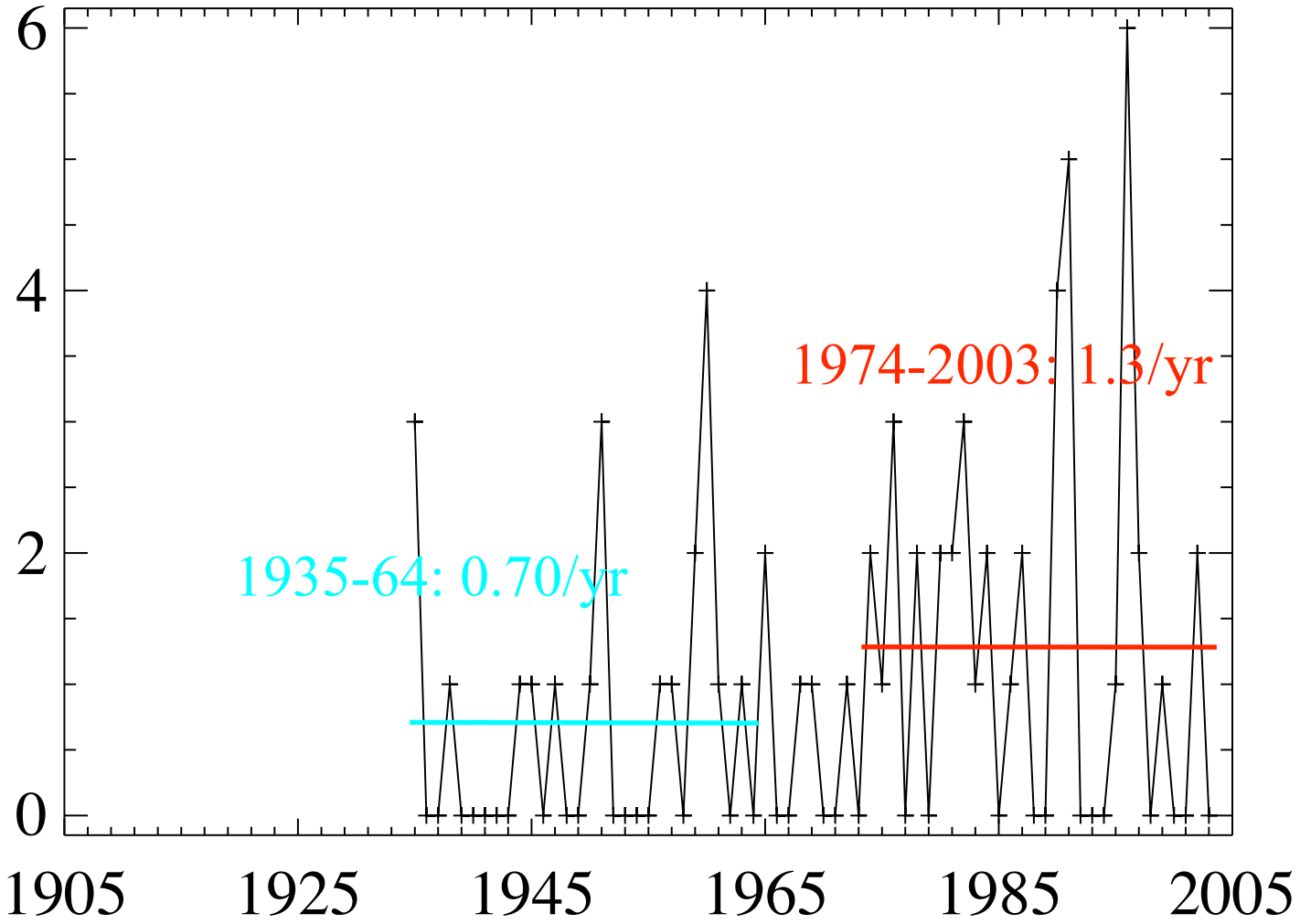
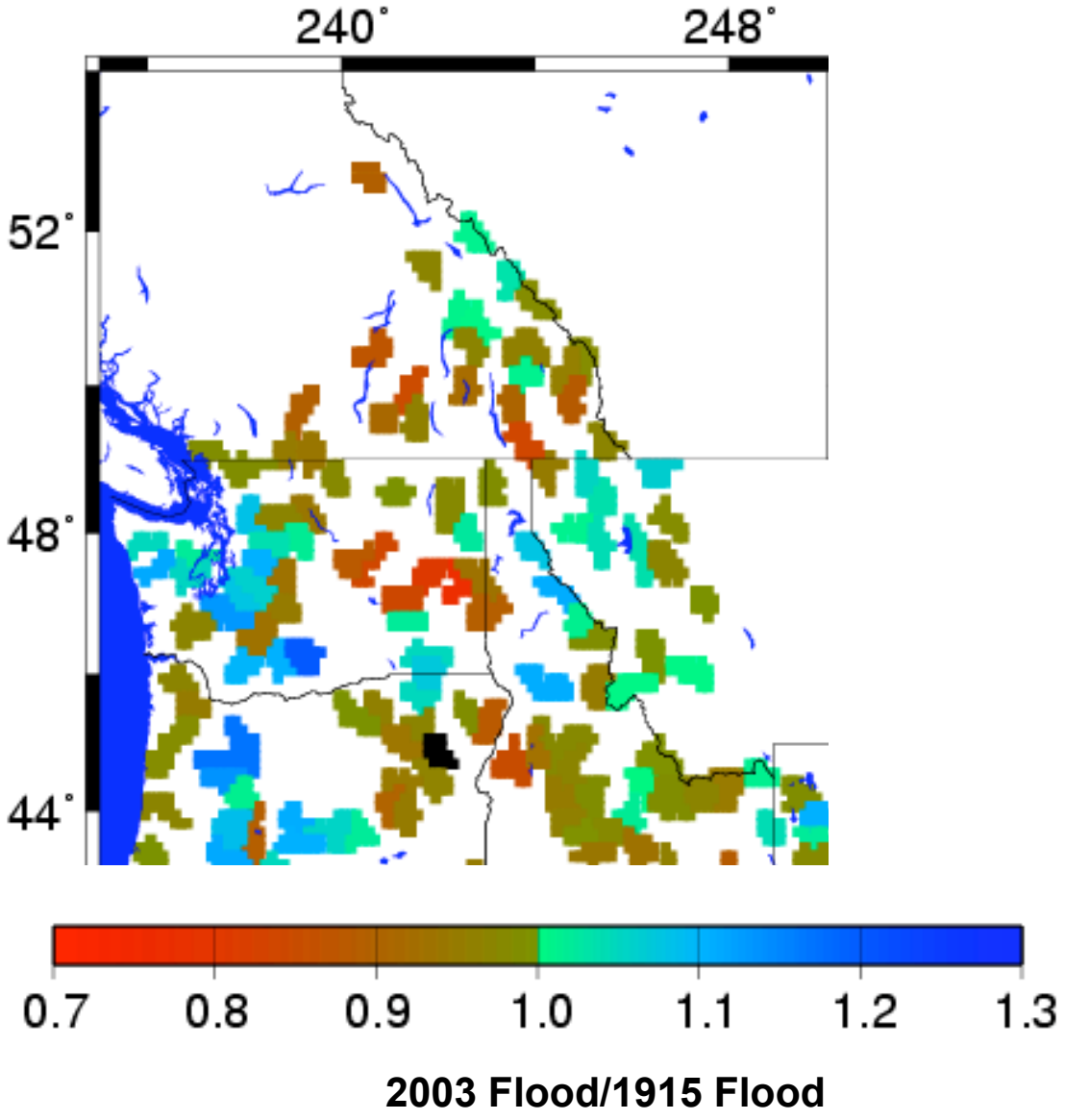


FIG. 8. Areas of significant trends in very heavy daily precipitation (above 99.7th percentiles) over the conterminous United States (1908–2000). Dark areas indicate increasing and hatched areas decreasing trends. Only trends that are statistically significant at the 0.05 significance level are shown. For seasonal precipitation, 99.7th percentile thresholds usually indicate daily rain events with a return period above 10 yr, while for annual precipitation it is in the range of 3–5 yr.

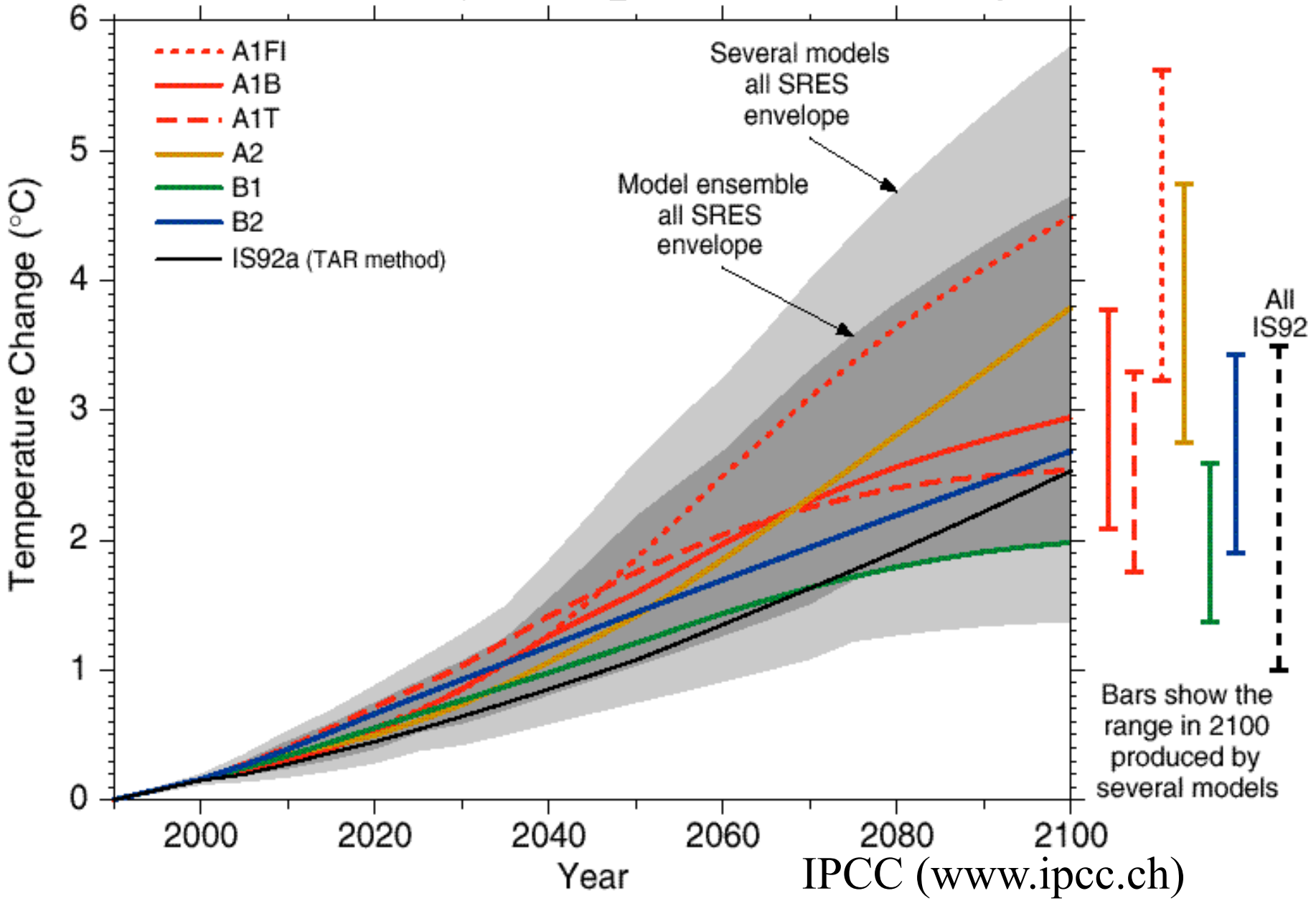
Observations suggest 1-year flood risk has doubled in Puget Sound region



Modeling suggests 20-year flood risk has mostly increased in western Washington, decreased in eastern Washington

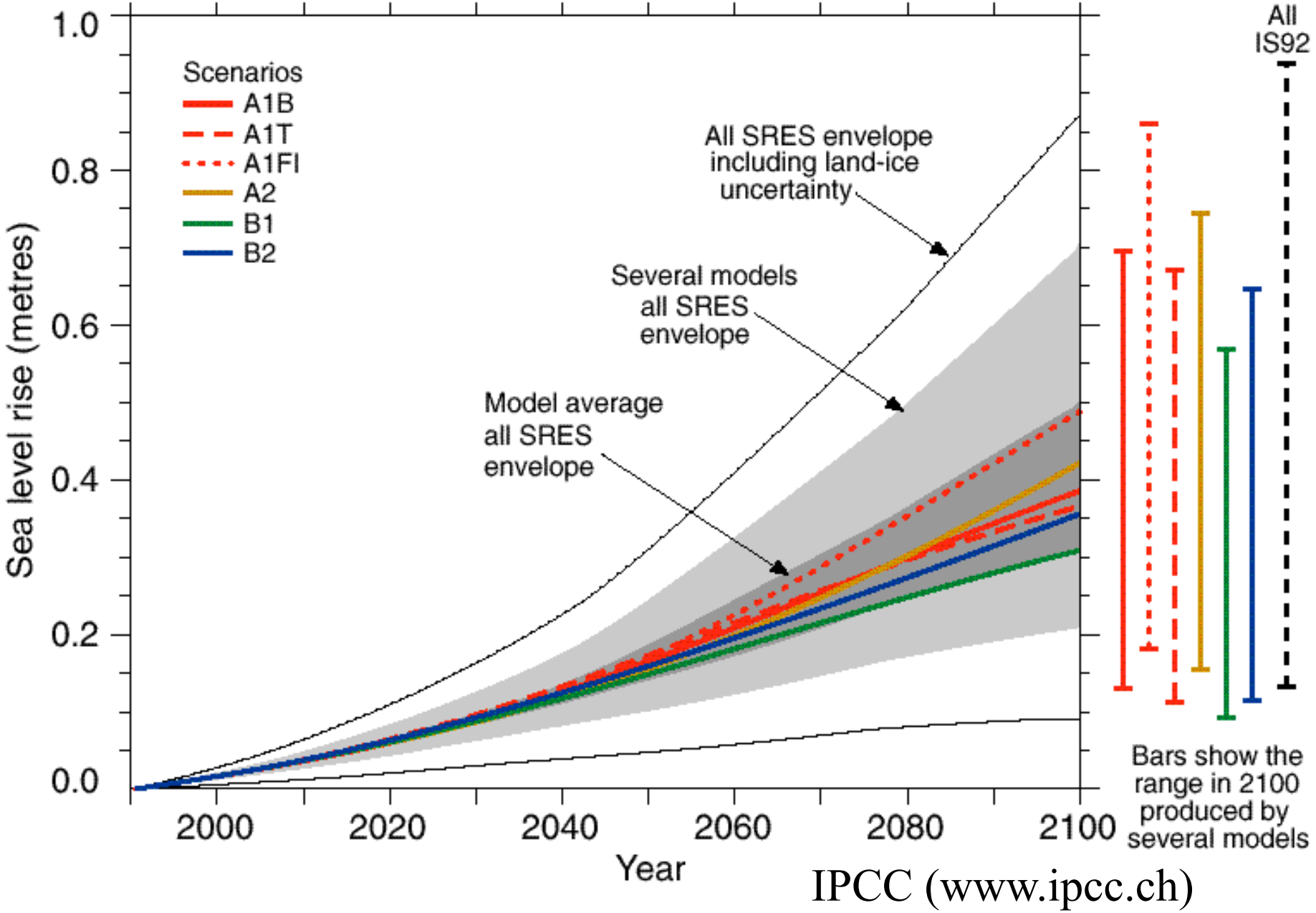


21st century temperature change

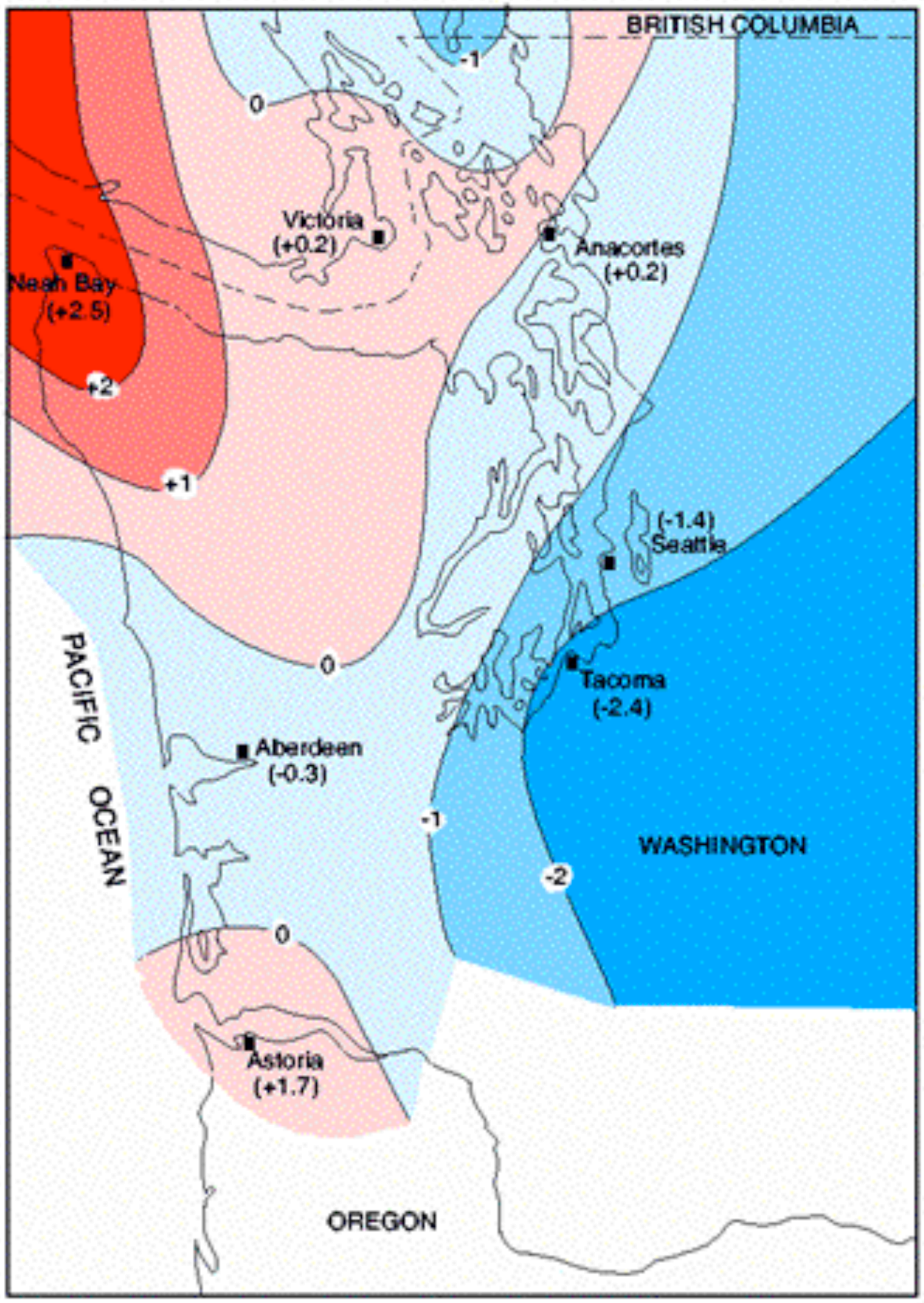


IPCC (www.ipcc.ch)

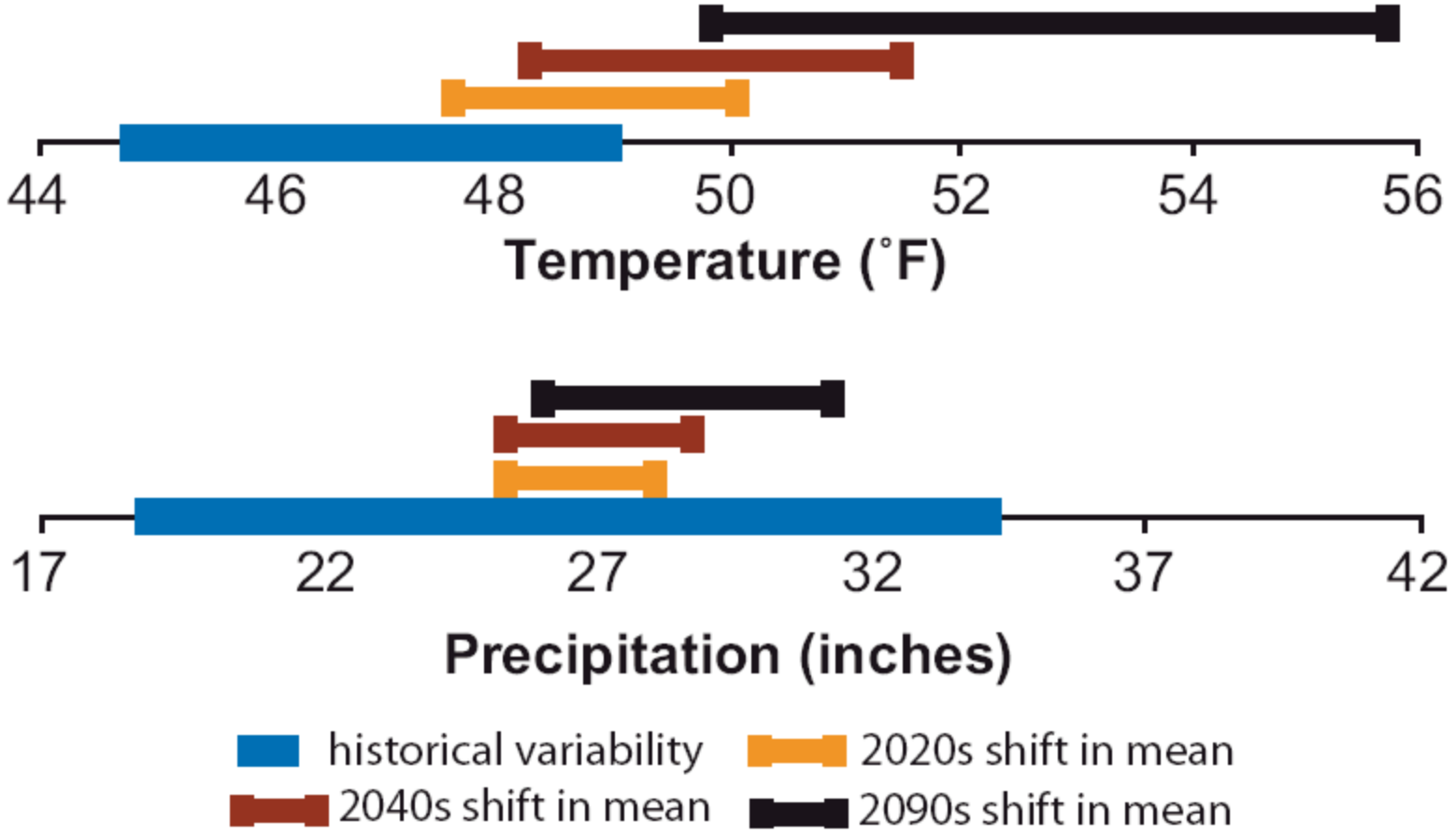
Sea level rise



IPCC (www.ipcc.ch)

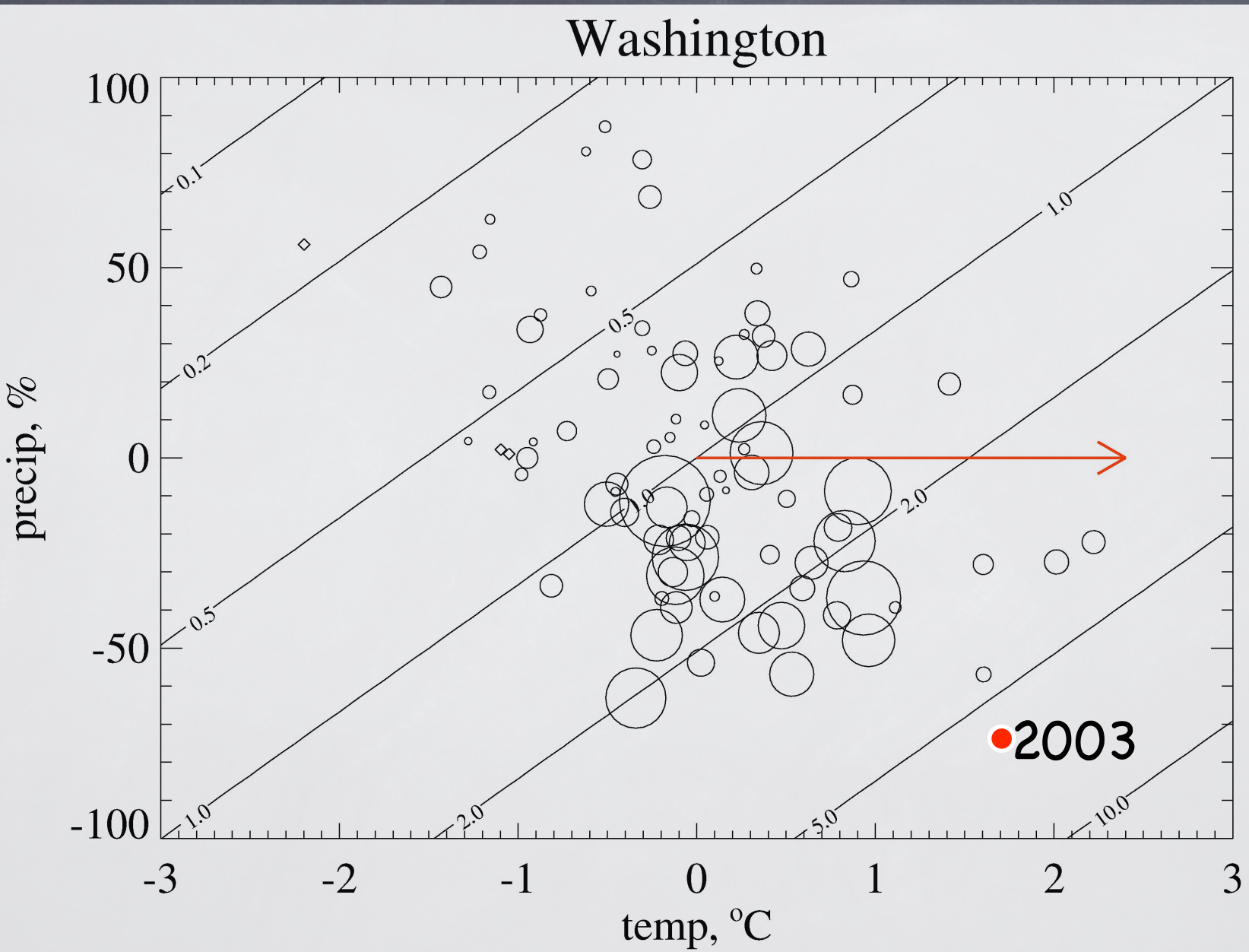


20th century sea level change depends on location



Comparison of observed year-to-year variability and projected shifts in temperature and precipitation from climate models

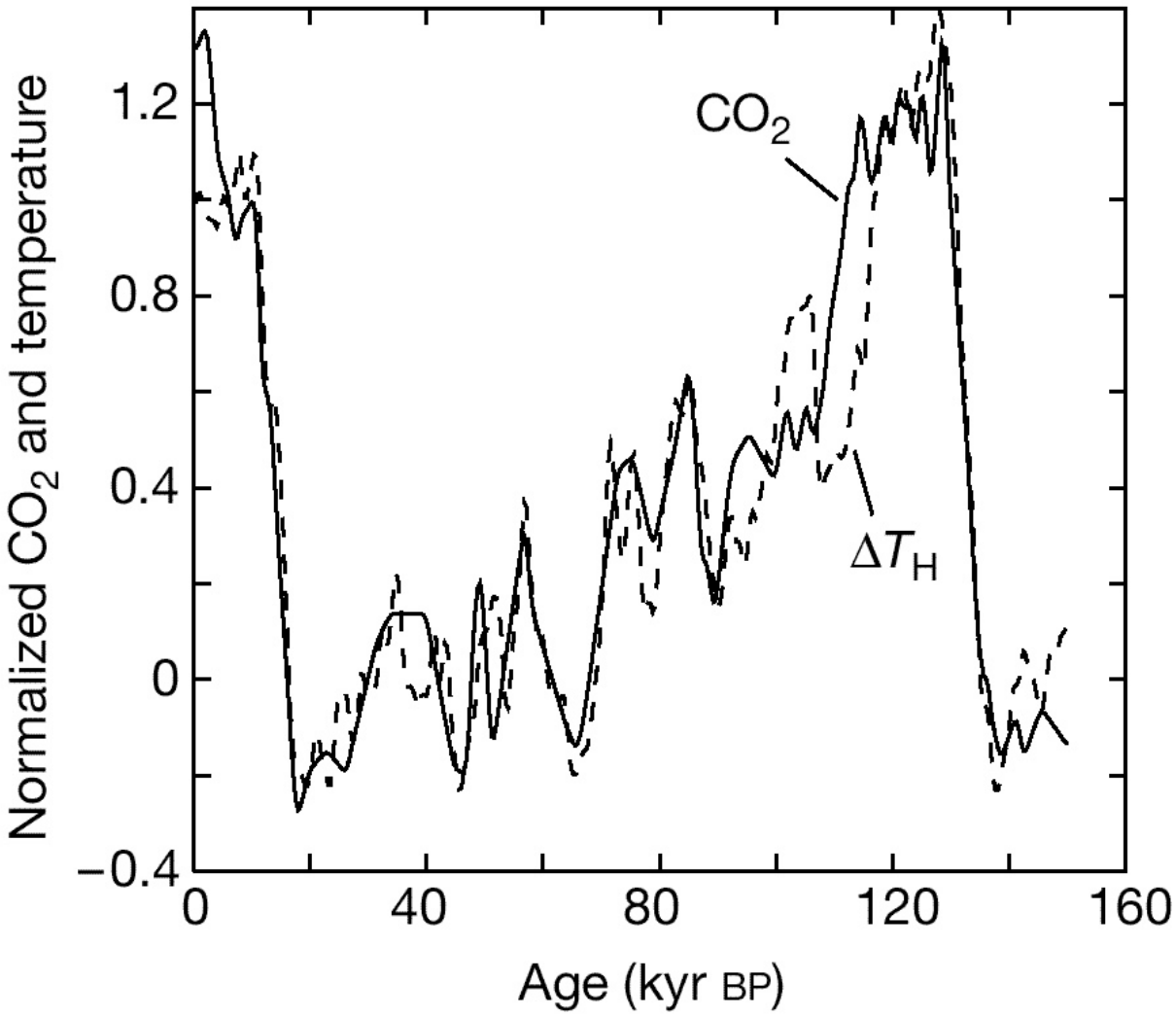
CLIMATE IMPACTS GROUP
Climate Science in the Public Interest


Washington
100
50
0
-50
-100
precip, %
-3
-2
-1
0
1
2
3
temp, °C
0.1
0.2
0.5
1.0
2.0
5.0
10.0
0.0
2003

Main points

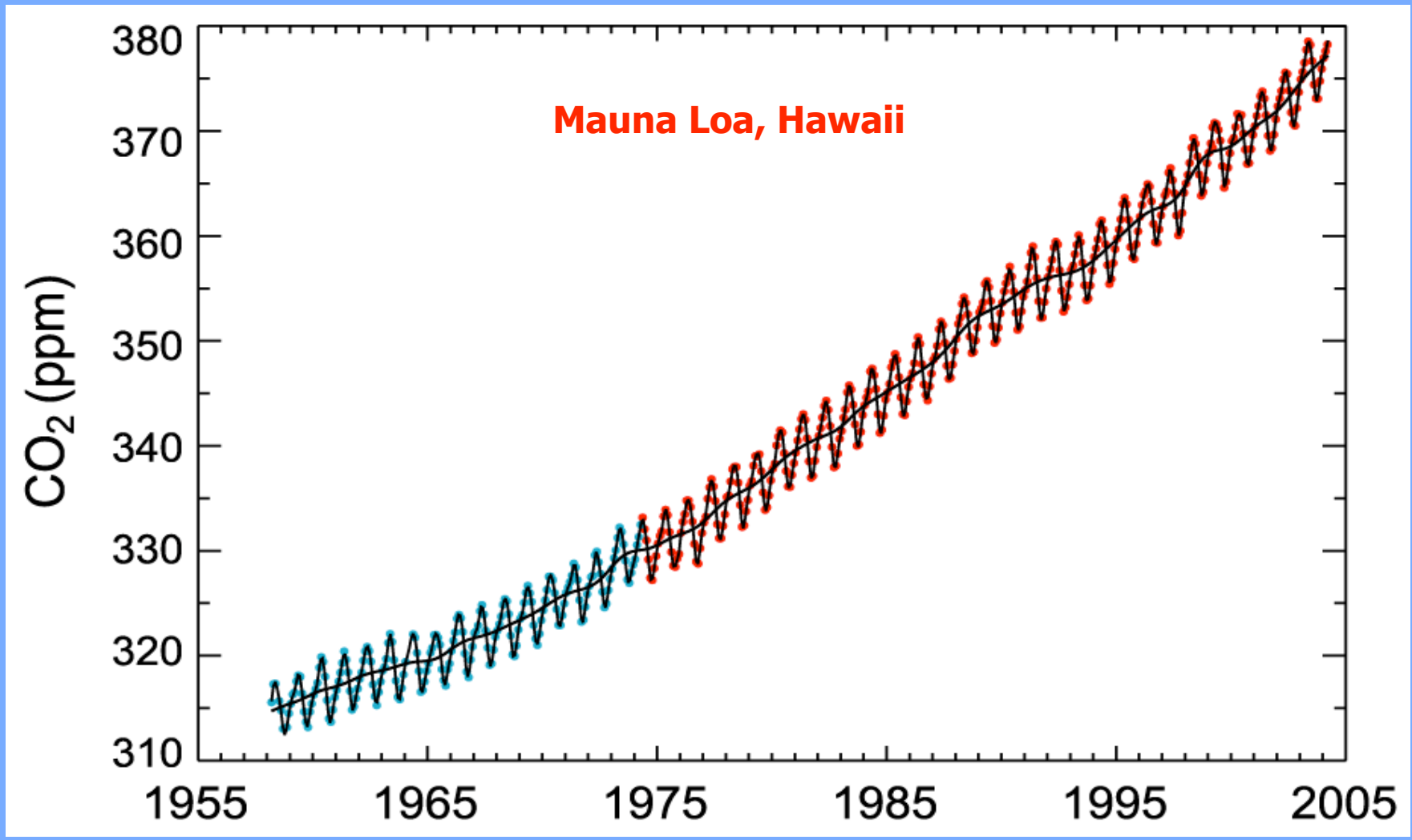
- Human influence on climate *has* emerged
- Northwest impacts of relevance include changing precipitation intensity and flood risk, sea level rise, forest fires

Temperature and CO2 vary together over glacial cycles



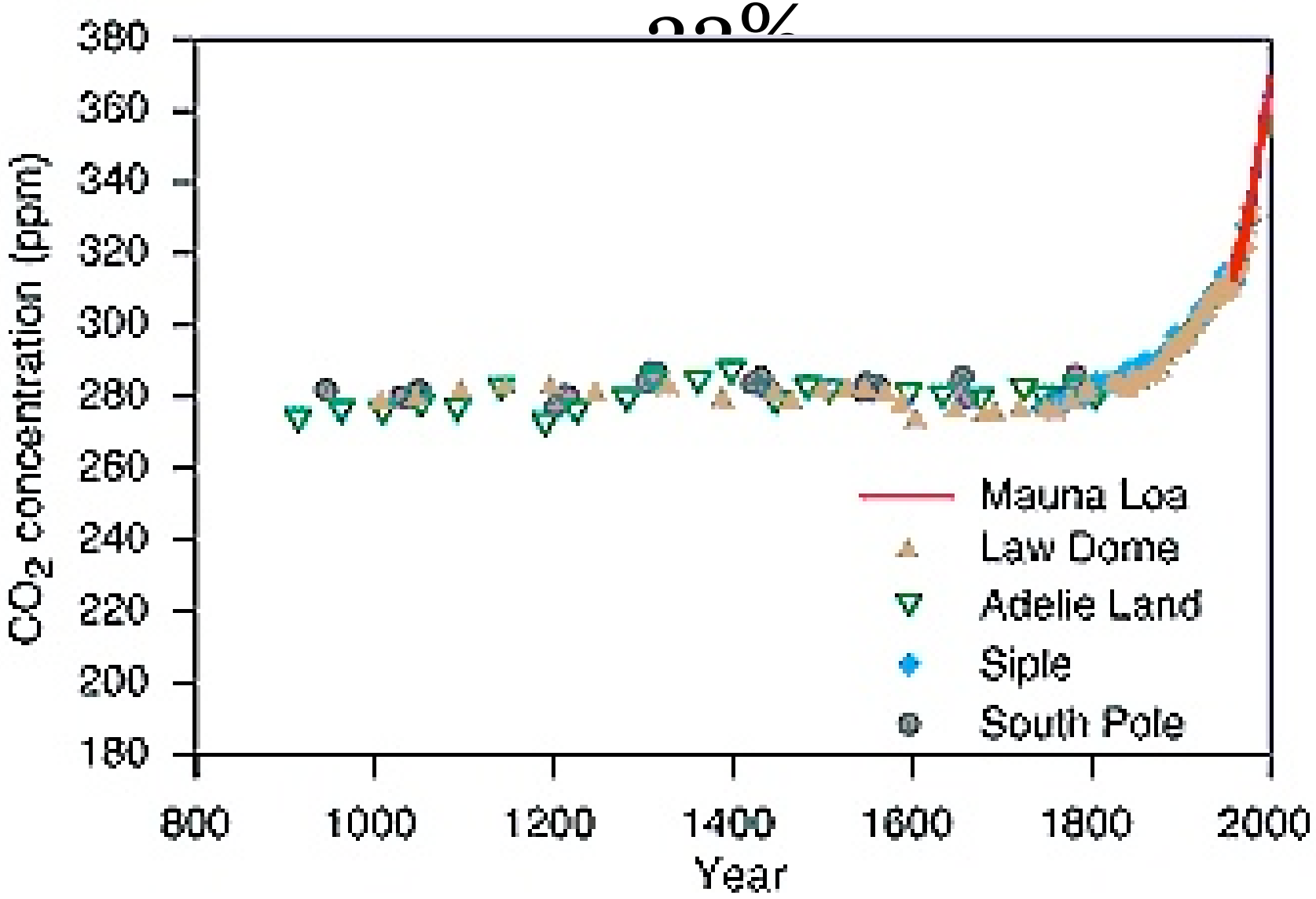
Source: Cuffey and Vimeux, Nature 412:523, 2001.

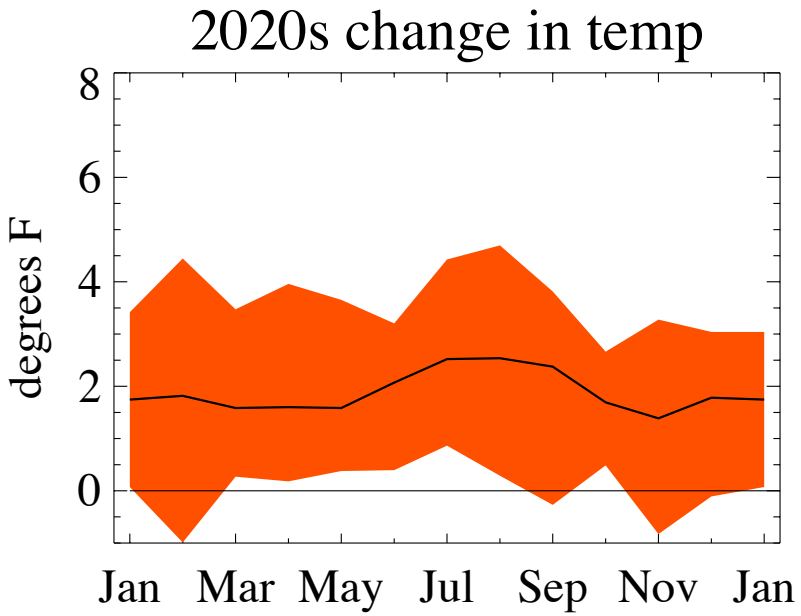
Changing atmospheric composition: CO_2

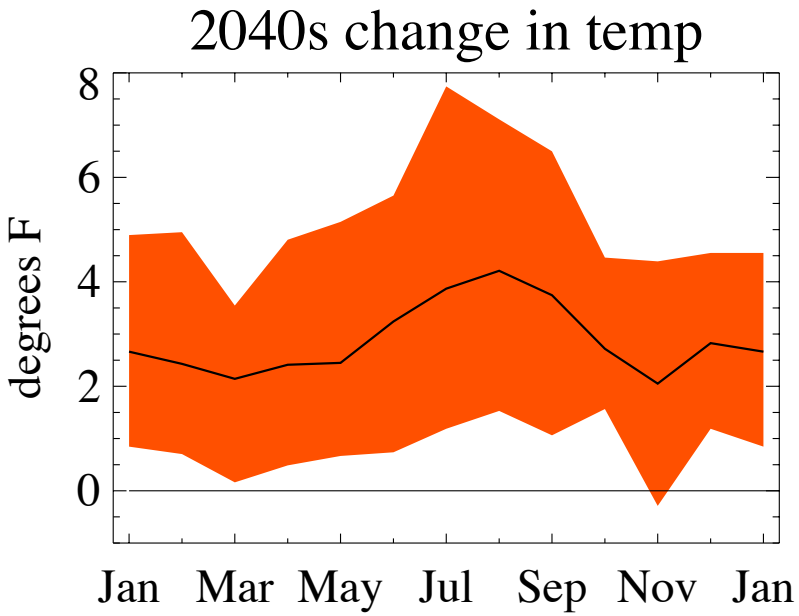


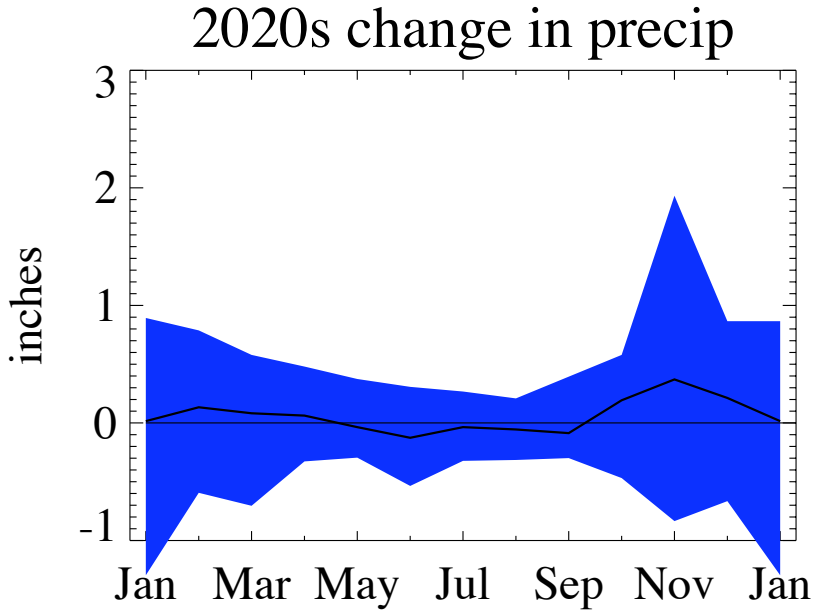
Data from Climate Monitoring and Diagnostics Lab., NOAA. Data prior to 1973 from C. Keeling, Scripps Inst. Oceanogr.

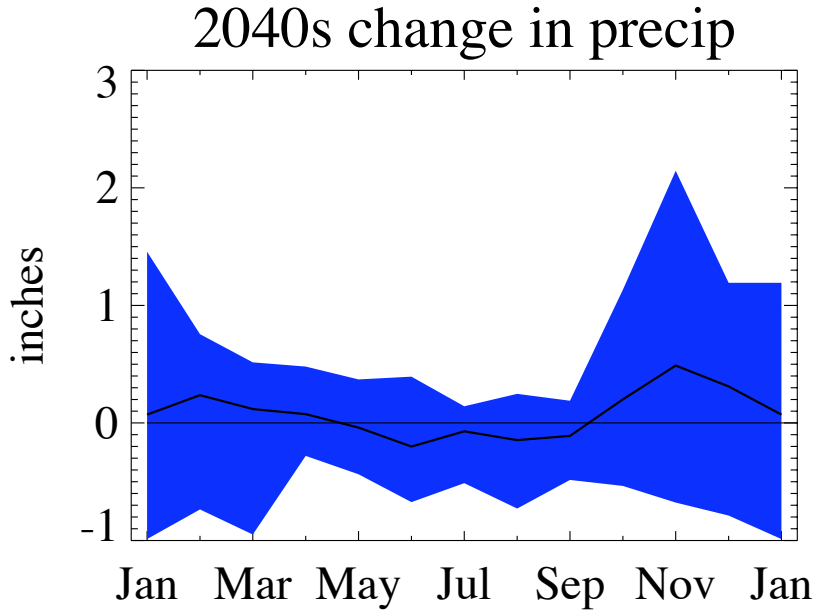
Carbon dioxide: up 32%




2020s change in temp
degrees F
8
6
4
2
0
Jan
Mar
May
Jul
Sep
Nov
Jan


2040s change in temp
degrees F
8
6
4
2
0
Jan
Mar
May
Jul
Sep
Nov
Jan


2020s change in precip
inches
3
2
1
0
-1
Jan
Mar
May
Jul
Sep
Nov
Jan


2040s change in precip
inches
3
2
1
0
-1
Jan
Mar
May
Jul
Sep
Nov
Jan